



INSTALLATION AND WIRING

SERIES 532 AND 537

SINGLE OUTPUT SOLID STATE INDICATING CONTROLLERS

1. After Unpacking

This instrument has been manufactured carefully, inspected, and packed at the factory. Check the contents of the shipping container against the packing slip. If the equipment is damaged in transit, report the extent of the damage to the carrier immediately. Repack in the original box until ready for installation. Any instructions given on tags attached to the instrument should be followed carefully and then the tags should be removed. Handle with care.

2. Mounting

Refer to figure 1.

Locate the instrument to avoid excessive dust or oil accumulations, and moisture. The ambient temperature should be within 40°F to 130°F. The series 530 can be mounted in any position. Avoid furnace walls and other sources of radiant heat.

Minimum practical center to center distance for mounting controllers is 4-1/2 inches. This distance allows 1/8 inch between controller front panels, and takes into consideration the mounting bracket. The above distances assumes that there is room above and below the controller—enough room so that the controller can be pulled from its housing in the panel by its bezel. This is necessary to make side panel adjustments and to service the controller.

Push in firmly and at the same time turn the two screws in the front panel CW as many turns as required to hold the controller firmly against the instrument panel. To unlatch, push in firmly and turn the screws CCW.

MINIMUM PANEL CUTOUT SHOULD BE: 6-9/16 X 4-1/16
ALL DIMENSIONS ARE IN INCHES

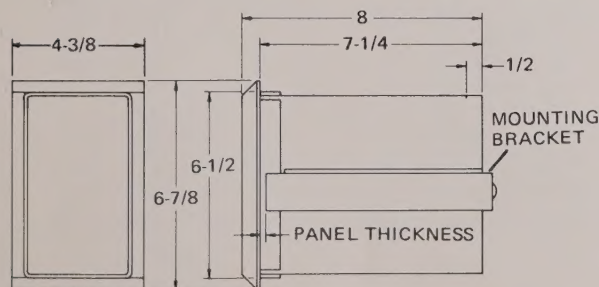


Figure 1. Mounting Dimensions

3. Power Wiring See figures 2 and 3.

Input line voltage must be either 120 Vac $\pm 10\%$ or 240 Vac $\pm 10\%$, 50 or 60 Hz.

4. Input Wiring See figures 2 and 3.

Do not place power wiring and thermocouple wiring in the same conduit or wiring trough. The wires from several thermocouples may be in the same conduit or wiring trough.

If shielded thermocouple leads are used, the shields should be insulated electrically and terminated at one location, preferably the chassis of the Series 530.

When the Series 530 is ordered, the type of thermocouple desired is specified. The Barber-Colman Thermocouple Catalog lists a complete selection of thermocouple assemblies and thermocouple extension leadwire. Thermocouples should never be wired to the Series 530 with ordinary copper wire. Wire only with thermocouple extension leadwire such as that specified in the Barber-Colman Catalog.

Observe the correct thermocouple and thermocouple extension wire polarity. The negative wire of both is usually coded red.

5. Deviation Alarm

5.1 High and Low Trip Point Connections

See figure 4. Normally controllers are shipped with a High Trip Point Connection on the Alarm Board. The controller may be changed from a high alarm trip connection to a low alarm trip connection by making connection changes on the Alarm Board. Proceed as follows.

1. The Alarm Board is a horizontal board about 3 inches wide by 2-1/4 inches deep located on the top front of the chassis. It is fastened to the upper frame by four screws.
2. Near the center of the board are three pins, labeled pins A, B, and C on figure 4.
3. Remove the end of the JUMPER connected to pin C.
4. Remove the wire from pin B and connect it to pin C.
5. Connect the loose end of the JUMPER to pin B.

5.2 Setting the Alarm Trip Point

The alarm has a trip point range of 10%. That is, it can be set to trip on a deviation from the selected set point in either direction up to 10% of span. The trip point of the alarm is set by adjusting the Alarm pot on the Alarm Board

CCW for a higher temperature and CW for a lower temperature trip point.

Figures 2 and 3 show the two normally open alarm terminals. When an alarm is tripped these two terminals are connected.

The alarm may either be set on an instrument work bench with a millivolt source input or on line.

5.2.1 With Millivolt Source Input

Proceed as follows.

1. Connect a dc millivolt source (B-C Portable Potentiometer Output) to the input terminals.
2. Adjust the dc millivolt source for the millivolt equivalent of midscale temperature.
3. Turn power on
4. Turn the front panel Set Point Drum to midscale temperature.
5. Increase (decrease for low trip point) output of source until the red process variable pointer indicates the desired deviation from set point.
6. Adjust the Alarm pot until the front panel ALARM lamp lights to indicate the alarm.

5.2.2 Process Input

Proceed as follows.

1. Allow the process to stabilize at the desired set point temperature.
2. Turn the front panel Set Point Drum until the ALARM lamp lights. Record the temperature difference between the red pointer and the green pointer at which this occurs, and quickly return the Set Point Drum to its original setting. The temperature difference recorded is the deviation temperature above set point at which the alarm trips.
3. Pulling the Series 530 from the housing immediately disconnects all rear panel connections. If the desired alarm setting was not obtained in step 2, pull the Series 530 from the panel and make a small adjustment toward the desired setting. Replace the controller back into the housing.
4. Repeat steps 1, 2, and 3 until the ALARM lamp lights at the desired trip point.
5. An extender assembly, which may also be used when servicing the Series 530, is available and makes this procedure much easier. Extender assembly extends interior pins of housing, forward, just enough to expose side panel controls.

Connect a jumper between terminal 2 and either the terminal marked 240V if the power supply is 240Vac or the terminal marked 120V if the power supply is 120Vac.

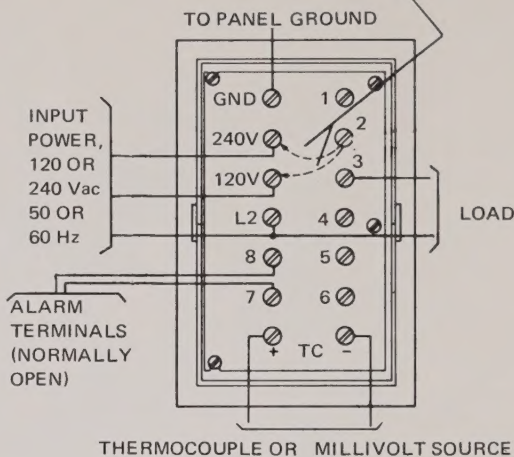


Figure 2. Wiring for Single Output Models with Solid State Switching Output

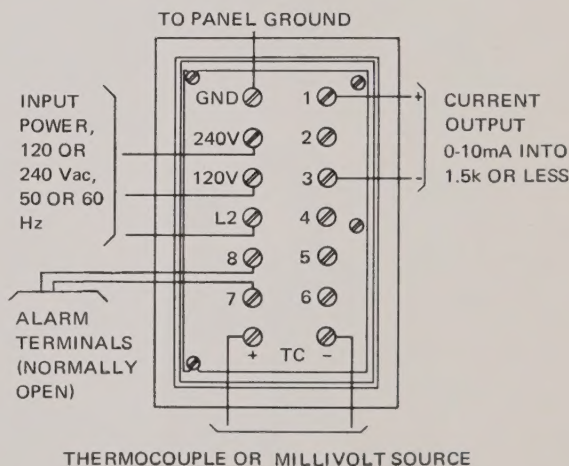
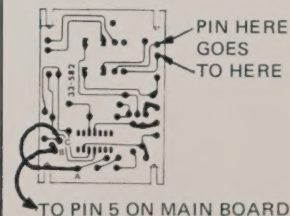
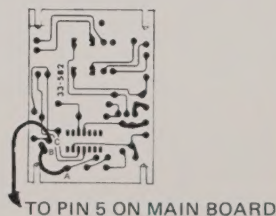


Figure 3. Wiring for Single Current Output Models

LOW TRIP POINT CONNECTIONS

HIGH TRIP POINT CONNECTIONS

TO CHANGE REAR PANEL ALARM TERMINALS 7 AND 8 TO NORMALLY CLOSED:



NORMALLY CONTROLLERS ARE SHIPPED WITH THIS HIGH TRIP POINT CONNECTION

Figure 4. Connections Viewed Through Top of Alarm Board

6. Operation

6.1 Front Panel Controls and Indicators

Setpoint Adjust

Single turn potentiometer for selecting the nominal setpoint temperature. Potentiometer is adjusted by rotating an eight inch scale fastened to a drum dial until the desired setpoint temperature coincides with a fixed centered green index.

Temperature Indicator

Red process variable pointer indicates temperature in degrees on the visible 20% of the eight inch temperature scale. Any deviation between the setpoint temperature and the process temperature may be observed on the calibrated scale.

ALARM Lamp

Only on models with an alarm. Amber lamp lights to indicate an alarm.

ON Lamp

Only on solid state switching output models. Red neon lamp lights to indicate heating contacts are closed.

OFF Lamp

Only on solid state switching output models. White lamp lights to indicate heating contacts are open and the process variable is cooling.

POWER Lamp

Only on current output models. Red neon lamp lights to indicate power is on to the Controller.

6.2 Internal Panel Controls

Pulling the Series 530 from the case immediately disconnects all rear panel connections. When adjusting the internal panel controls make repeated small adjustments. After making each small adjustment, insert the chassis fully back into the case, and allow the process to settle down before making the next small adjustment.

PROP. BAND Potentiometer

Single turn adjusted potentiometer for selecting a proportional band from 0.5 (fully CCW) to 50% (fully CW) of span.

AUTO RESET Potentiometer

Single turn potentiometer for selecting an automatic reset rate (integral rate) from .06 repeats per minute (fully CCW) to 3 repeats per minute (fully CW). Only on models with automatic reset.

OFFSET Adjustment Potentiometer (on side panel in 532C and 537G only)

Offset adjustment is satisfactory where the resulting

offsets from control action are small. Used where load conditions are repetitive and load upsets are negligible.

CYCLE Potentiometer

Only on solid state switching output models. Single turn potentiometer for selecting a cycle time from 10 to 24 seconds (at CW--fast cycling; at CCW--slow cycling).

6.3 Preliminary Adjustments

It may be necessary to operate the process equipment to make preliminary adjustments on it and also, for example, to dry out furnace liner material. During any preliminary operation, turn the AUTO RESET control off. Set the PROP. BAND control to 0.5%. Now adjust the Setpoint Adjust control as desired.

Always make a permanent record of any final settings for a specific process so that if the controls are changed for any reason, the original settings can be duplicated. Upsets can be simulated by turning the Setpoint Adjust control to different settings with the degree of upset desired proportional to the change in setting. Allow enough time, when making adjustments, for the system to stabilize. Remember that optimum controller adjustments are those that produce satisfactory results in a stable system. Optimum adjustments are not necessarily the finest and most sensitive settings that can be obtained.

6.4 Controller with Proportional Action

The output of the Series 530 is a proportional output correction signal for returning the process variable to the setpoint selected on the Setpoint Adjust control. The amount of amplification is selected by the operator on the PROP. BAND control. This amplification is inversely proportional to the percent markings of the PROP. BAND control. At a setting of 0.5% (fully CCW), proportional gain is maximum, but the proportional band (width) is minimum. At a setting of 50% (fully CW), proportional gain is minimum, but the proportional band (width) selected of the controller's output range is maximum. Set the PROP. BAND control high enough to produce as close as possible to a straight line, but no higher. If there is overshoot of the setpoint or more than minimum recovery time from a step change in the process variable, increase the band width (which reduces the gain) to obtain minimum recovery time. With proportional action only there may be an offset (droop) of the measured variable from the setpoint selected on the Setpoint Adjust control, unless the power requirement is 50% (balanced).

The OFFSET Adjustment is factory set for 50% output at zero deviation indication. Where the output of the controller or final control element can be measured, the following procedure will obtain an optimum setting of the OFFSET Adjustment Potentiometer.

1. Connect extender assembly between the chassis and the connector inside the housing. CAUTION: Line

voltage is on exposed pins of the extender assembly. If an extender assembly is not available, the technique of making repeated small adjustments (see paragraph 6.2) may be used.

2. Allow the process to stabilize at the desired setpoint.
3. Record the reading of the front panel meter.
4. Turn the Setpoint Adjust control until there is zero deviation between the process temperature and the setpoint.
5. Adjust the OFFSET Adjustment Potentiometer until the front panel meter indicates the reading recorded in step 3.
6. Restore the Setpoint Adjust control to the desired setpoint.
7. In processes with a wide proportional band, this procedure may have to be repeated.

6.5 Controller with Proportional Action and Integral (Automatic Reset) Action

The following procedure gives initial settings that represent a compromise between close control of minor process upsets and good recovery from large upsets. Allow plenty of time for the process to stabilize after each adjustment. Proceed as follows.

1. Set the PROP. BAND control at midpoint.
2. Set the AUTO RESET control to off.
3. Set the Setpoint Adjust control to the desired operating setpoint.
4. Allow plenty of time for the controlled variable to stabilize at the operating setpoint.
5. For either of the two conditions (A or B) that follow, after each change in setting of the PROP. BAND control, a simulated process upset should be caused by changing the Setpoint Adjust control about 5% (this is 50°F for a scale of 1000°F) of scale range. Such a simulated process upset will show any tendency to cycle. Changes in the setting of the Setpoint Adjust control should be made up and down alternately to remain near the operating setpoint selected in step 3.
 - A. If the process variable is stable, turn the PROP. BAND potentiometer counterclockwise in steps of one division until instability is reached. After the process becomes unstable, turn the PROP. BAND potentiometer clockwise one division.
 - B. If the process variable is unstable, turn the PROP. BAND potentiometer clockwise until the process variable becomes stable. After the process variable

becomes stable, turn the PROP. BAND potentiometer one more division clockwise.

6. After the completion of step 5, allow time for the process to settle down. Then turn the AUTO RESET potentiometer to the mid-point position, and observe the behavior of the process.
 - A. If the mid-point setting is the correct one, the proportional offset read on the temperature scale of the front panel meter at the end of step 5 will disappear in about 2 to 5 minutes, without overshoot.
 - B. If the mid-point setting is too fast for the process, cycling will occur. If cycling occurs, turn the AUTO RESET potentiometer fully CCW.
7. Introduce a step change of 5% to 10%. For best results, the step response should be observed on a recorder. With a recording very fine observations can be made to obtain closer to optimum settings. Taking a recording is almost mandatory for very critical processes, where both overshoots and settling times must be minimized. Fortunately, the majority of processes are not so critical and satisfactory results may be obtained without special equipment simply by observing the deviation. Monitoring the output on the current output models is also very helpful in searching for a tendency to cycle, but usually is not necessary.
 - A. If more overshoot occurs than can be tolerated, increase the setting of the P.B. control clockwise in steps of about one division. If more than two steps are required, it may be preferable to turn the AUTO RESET control to a lower setting, rather than to continue on to an unusually wide proportional band.
 - B. If there is no overshoot, the time required to reach the new equilibrium may be excessive-- at any rate, it can be reduced by reducing the proportional band until a single, small overshoot occurs in response to a step change. Such a setting is usually preferred, as settling time is minimal. If more than three steps are required to obtain an overshoot, it may be preferable to advance the reset control to fully CW, then widen the proportional band to achieve stability.

6.6 Cycle Time

Models with solid state switching outputs are provided with a Cycle Time adjustment for varying the pulse rate from 10 (at CW) to 24 (at CCW) seconds per cycle. The faster cycle rates of the order of 10 seconds per cycle provide better control of loads with fast response times and little time lag. However, a relatively faster cycle time causes added wear on an external contactor.



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